Critical thinking as a self-regulatory process component in teaching and learning

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This article presents a theoretically grounded model of critical thinking and self-regulation in the context of teaching and learning. Critical thinking, deriving from an educational psychology perspective is a complex process of reflection that helps individuals become more analytical in their thinking and professional development. My conceptualisation in this discussion paper argues that both theoretical orientations (critical thinking and self-regulation) operate in a dynamic interactive system of teaching and learning. My argument, based on existing research evidence, suggests two important points: (i) critical thinking acts as another cognitive strategy of self-regulation that learners use in their learning, and (ii) critical thinking may be a product of various antecedents such as different self-regulatory strategies.

An Overview of self-regulated learning

Critical thinking is an important theoretical orientation that serves to help students’ motivation in the teaching and learning processes. The concept of critical thinking arises from the practice of reflective thinking (Leung & Kember, 2003; Phan, 2007, 2008a), where this construct has been shown to relate positively to students’ academic success (Lee & Loughran, 2000). Critical thinking helps individuals to think and analyse critically about their own learning, and to strive and develop expertise in their areas of professionalism. In the area of teaching and learning, for example, the practice of critical thinking has provided pre-service student teachers with the skills to improve and develop their pedagogical teaching skills. More recently, considerable research interest has been directed towards understanding the process of critical thinking, and how this concept may fit into the main framework of self-regulated learning and motivation (e.g., Leung & Kember, 2003; Phan, 2007, 2009). Further to this research development, researchers in educational psychology have recently acknowledged that motivation and its related constructs may vary in terms of subject area and sociocultural context (Boekaerts, 2001; Heikkilä & Lonka, 2006; Walker, Pressick-Kilborn, Arnold, & Sainsbury, 2004).

In view of the important theoretical and educational implications that arise from critical thinking, this article explores how this practice may fit in with the framework of self-regulation. In the first part of this article, I present a theoretical overview of self-regulated learning and the notion of self-regulated learners. I conclude this article by proposing a conceptualisation that accentuates a possible dialectical relationship between the two theoretical orientations.

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Since its emergence as a theory in educational psychology, self-regulation has been written on and researched extensively (e.g., Boekaerts & Niemivirta, 2000; Pintrich, 2004; Pintrich & De Groot, 1990; Vermunt & Verloop, 1999; Martínez & De la Fuente, 2004; Villach & Llano, 2007). There is a voluminous body of research in motivation that reflects the importance of self-regulation in mathematics, social studies, and writing (e.g., Hammann, 2005; Stodolsky, Salk, & Gałęsner, 1991; Wolters & Pintrich, 1998).

So what is self-regulation and how does it lead to individual differences in student learning? According to Zimmerman (1989), self-regulated learners are those who are “metacognitively, motivationally, and behaviourally active participants in their own learning process” (p. 4). In a more simplistic form, a self-regulated learner is more inclined to set task-related, reasonable goals, take responsibility for his or her learning, and maintain motivation (Heikkilä & Lonka, 2006). It is also assumed that students who are regulated in their learning ability to use and change a variety of cognitive (e.g., rehearsing, memorising, organising) and metacognitive (e.g., goal setting, planning, monitoring, self-evaluation) strategies to accomplish academic tasks. Subsequent research (e.g., Como, 2001; Weinstein, Husman, & Dierking, 2000; Zimmerman, 2002) adhering to the theoretical framework of self-regulation has shown that self-regulated learners manifest a number of distinctive characteristics (see Montalvo & Torres, 2004).

As described by Weinstein (1996) more than a decade ago, research development pertaining to self-regulation is diverse and has resulted in various thematically-related theoretical models and paradigms (see Boekaerts, Pintrich, & Zeidner, 2000; Puustinen & Pulkinnen, 2001 for analysis). Although there are various theoretical models of self-regulation, most frameworks assume that self-regulated learners engage in the use of both cognitive and metacognitive strategies for learning (Vanderstoep, Pintrich, & Pulkinnen, 2001 for analysis). There are various theoretical models of self-regulation, most frameworks assume that self-regulated learners engage in the use of both cognitive and metacognitive strategies for learning (Vanderstoep, Pintrich, & Fagerlin, 1996; Wolters & Pintrich, 1998). Furthermore, most theoretical models of self-regulation assume learners also endorse adaptive motivational beliefs in learning (Pintrich & De Groot, 1990; Zimmerman, 1989, 1994). A possibly important view is that self-regulation is a proactive process (Zimmerman, 2008), where this enables learners to acquire academic skill, such as setting goals, selecting and deploying strategies, and self-monitoring one’s own effectiveness. It is not, in contrast, a reactive process that happens as a result of impulsive forces.

One particular model, for example, is the Pintrich (2000) model of self-regulation. Pintrich’s (2000) theoretical framework is based on the socio-cognitive perspective of learning (Bandura, 1997, 2001; Schunk, 2001), where self-regulatory processes are organised according to four phases: (i) planning, (ii) self-monitoring, (iii) control, and (iv) reflection or evaluation. Within each of these four phases, self-regulation activities are in turn structured into four areas: cognitive, motivational/affective, behavioural, and contextual (see Table 1). According to Pintrich (2000), the four phases of self-regulatory processes described (see Montalvo & Torres, 2004; Pintrich, 2000) reflect a general sequence that learners go through as they carry out the specific tasks; however, these phases are not hierarchically or linearly structured (Montalvo & Torres, 2004). Accordingly, the four phases can occur simultaneously and dynamically, producing multiple interactions between the different processes and components. The Pintrich framework is comprehensive and global, providing a basis for educators to analyse in detail the different cognitive, motivational/affective, behavioural and contextual processes that nurture and enhance self-regulated learning (Pintrich, 1999).

Likewise, the Zimmerman (1998) theoretical model of self-regulation describes three cyclical phases that are similar to those discussed in Pintrich’s (2000) model (Pintrich & Zusho, 2002; Zimmerman, 2002). The forethought phase, referring to processes and beliefs that occur before efforts to learn, encompasses two major processes: task analysis (including goal setting and strategic planning) and self-motivational beliefs (including self-efficacy beliefs, outcome expectations, intrinsic interest/value, and learning goal orientation). The performance phase, referring to processes that occur during behavioural implementation, falls into two classes: self-control (including the use of imagery, self-instruction, attention focusing, and task strategies) and self-observation (refers to self-recording personal events or self-experimentation). The self-reflection phase, referring to processes that occur after learning efforts, encompasses two major classes of processes: self-judgment (including self-evaluation and causal attributions) and self-reaction (involves feelings of self-satisfaction and positive affect; adaptive/defensive responses). The Pintrich and the Zimmerman models of self-regulation, as well as others, have spawned various theoretical and empirical contributions from researchers over the past three decades (e.g., Bockaerts et al., 2000; Corno, 1989; Miller & Brickman, 2004; Pintrich, 2000; Schunk & Zimmerman, 1994, 1998; Zimmerman, 2002; Zimmerman & Schunk, 1998).

### Table 1

<table>
<thead>
<tr>
<th>Phases</th>
<th>Cognition</th>
<th>Motivation/Affect</th>
<th>Behaviour</th>
<th>Context</th>
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<tr>
<td>Forethought planning, and activation</td>
<td>Target goal setting&lt;br&gt;Metacognitive knowledge activation</td>
<td>Goal orientation adoption&lt;br&gt;Efficacy judgments&lt;br&gt;Ease of learning judgments&lt;br&gt;perceptions of task difficulty&lt;br&gt;Self-efficacy beliefs&lt;br&gt;Intrinsic interest</td>
<td>Time and effort planning&lt;br&gt;Planning for self-observation of behaviour</td>
<td>Perceptions of task&lt;br&gt;Perceptions of context</td>
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<tr>
<td>Monitoring</td>
<td>Metacognitive awareness and monitoring of cognition</td>
<td>Awareness and monitoring of motivation and effort&lt;br&gt;Task value activation&lt;br&gt;Interest activation</td>
<td>Monitoring changing task&lt;br&gt;Behaviour change conditions</td>
<td>Monitoring changing task&lt;br&gt;Behaviour change conditions</td>
</tr>
<tr>
<td>Control</td>
<td>Selection and adaptation of cognitive strategies for learning, thinking</td>
<td>Selection and adaptation of strategies for managing motivation and affect &lt;br&gt;Persistence&lt;br&gt;Help-seeking behaviour</td>
<td>Increase/decrease effort&lt;br&gt;Help-seeking behaviour</td>
<td>Change or renegotiate task&lt;br&gt;Change or leave context</td>
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<tr>
<td>Reaction and reflection</td>
<td>Cognitive judgments&lt;br&gt;Attributions&lt;br&gt;Interest&lt;br&gt;Value &lt;br&gt;Helpfulness&lt;br&gt;Help seeking&lt;br&gt;Self-efficacy beliefs&lt;br&gt;Planning&lt;br&gt;Monitoring&lt;br&gt;Motivation&lt;br&gt;Attitudes&lt;br&gt;Knowledge&lt;br&gt;Skills&lt;br&gt;Strategy&lt;br&gt;Control&lt;br&gt;Reflection</td>
<td>Affective reactions&lt;br&gt;Help-seeking&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness&lt;br&gt;Helpfulness</td>
<td>Behaviour choice&lt;br&gt;Evaluation of task&lt;br&gt;Evaluation of context</td>
<td>Evaluation of task&lt;br&gt;Evaluation of context</td>
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Critical thinking: Theoretical overview

The notion of critical thinking, or commonly known as critical reflection, has been widely researched in various professional fields, such as psychology, education, teaching and learning, etc (Grushka, McLeod, & Reynolds, 2005; Harrison, Lawson, & Wortley, 2005; Pedro, 2005; Willsen & Binker, 1993; Yanchar, Slife, & Warne, 2008). Furthermore, similar to the various theoretical frameworks of self-regulation that have been advocated (Weinstein, 1996), critical thinking has a number of diverse and varied definitions that reflect its complexity (Petrey, 2004; Yanchar et al., 2008). For example, Scriven and Paul (cited in Petrey, 2004, p. 463) refer to critical thinking as a process and not as an end in itself: “Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analysing, synthesising, and/or evaluating information gathered from or generated by: observation, experience, reflection, reasoning, or communication, as a guide to belief and action”. Similarly, Warnick and Inch define critical thinking as “involving the ability to explore a problem, question, or situation; integrate all the available information about it; arrive at solution or hypothesis; and justify one’s position” (cited in Petrey, 2004, p. 461).

Critical thinking has received considerable research interest in the field of education and psychology. This emerging interest, as reflected by the recent appearance of a journal entitled Reflective Practice, pertains to the importance of critical thinking and how this practice fits in with teaching and learning processes, as well as the development of specific skills required for reflection itself.
goals and study processing strategies has been documented in a current literature of motivation, the role of effort in achievement found to relate positively with the four phases of reflection. In the process of studying (Zimmerman & Risemberg, 1997), was also a recent study (Phan, 2009), I found that reflection (but not critical thinking) is more influential to the use of reflection and critical thinking, as these two complex phases facilitate a better understanding of the reflective thinking. I found from path analytical procedures that students’ academic self-efficacy beliefs were predictive of the phases of reflective thinking (with the exception of critical thinking). This absence of a significant bivariate association between critical thinking and self-efficacy, and likewise effort and deep processing strategies, is perplexing and suggests the need for researchers to advance this area of inquiry. Despite this nonsignificance, the finding between the three lower phases of reflective thinking and self-efficacy supports previous research studies (e.g., Pajares, 1996, 1997; Pajares & Johnson, 1996; Pajares & Kranzler, 1995) and emphasizes the salient role of self-efficacy. Individuals who are self-efficacious are more likely to engage in reflective thinking practice in their learning.

The seminal research by Leung and Kember (2003) provided a basis for further examination of the underlying mechanism of reflective thinking practice and its relations with other motivational variables. In a longitudinal panel study (Phan, 2008b), I examined a cohort of tertiary students over a one-year period. I subjected the data to a series of structural equation models and found that epistemological beliefs positively predicted students’ engagement in reflective thinking practice. This evidence, in line with existing research findings (e.g., Leung & Kember, 2003; Phan, 2006, 2007) and my previous findings (e.g., Phan, 2007, 2008a, 2009), suggests that there are various antecedents that shape the experience of reflective thinking practice.

In conclusion, works previously cited attest to the importance of critical thinking in the context of educational psychology of teaching and learning. Unlike other areas of psychology (Baron, 2000; Sternberg, 2003; Watson & Gleser, 1980; West et al., 2008; Yanchar et al., 2008), critical thinking is emerging as a disciplinary practice in educational psychology. By all means, taking into consideration the long history and debate surrounding the meaning of critical thinking (Thayer-Bacon, 2000; Yanchar et al., 2008), I realise that no definition or paradigm is likely to be universally accepted or that it could capture the nuance that surrounds its complexity. As a separate disciplinary practice in educational psychology, critical thinking may include a number of key characteristics that I outlined previously. Indeed, from the approach that I have taken, there is evidence at present to confirm...
the complexity of critical thinking (e.g., Kember et al., 2000; Leung & Kember, 2003; Phan, 2007, 2009), and how this high-order level of reflective thinking affects students’ academic learning and development. The positive interrelatedness with other motivational variables also validates the potential role of critical thinking in the learning process. One critical facet of critical thinking that may be advanced further includes its intricate association to the strategies of self-regulation. Extrapolating the theoretical contentions and empirical evidence from these two lines of research may elucidate this matter.

**Critical thinking and the self-regulated learner**

In the preceding sections of this article, I outlined two major theories in educational psychology: self-regulation and critical thinking. Situating these two theoretical orientations within one framework, my conceptualisation in this article addresses two fundamental issues: (i) that critical thinking, as a cognitive practice, helps in self-regulated learning, and (ii) the subprocesses involved in self-regulation assist in the development of critical thinking skill. The theoretical facets of both frameworks, as indicated previously, suggest that the subprocesses involved in self-regulation and critical thinking coexist in a dynamic system of change. In the advancement of this discussion, I adhere closely to existing literature and contend that both critical thinking and self-regulation, as distinct disciplinary practices, interact intricately to contribute to students’ growth and development (Ignatavicius, 2001; Kuiper, 2002; Leung & Kember, 2003; Paris & Newman, 1990; Schunk & Zimmerman, 1994; Vanderstoep et al., 1996; Weinstein & Mayer, 1986; West et al., 2008; Yanchar et al., 2008; Zimmerman, 2002).

Despite the evolving and development of different theoretical paradigms of self-regulation (Pintrich & De Groot, 1990; Pintrich & Zusho, 2002; Puustinen & Pulkkinen, 2001; Vanderstoep et al., 1996; Zimmerman, 1994, 2002), one aspect that is shared amongst researchers concerns the notion that learners use various cognitive strategies (e.g., using rehearsal, elaboration, and organisational strategies) to help them encode, recall, and comprehend classroom material. The use of these cognitive strategies reflects a commitment and a deeper level of cognitive engagement, and in turn results in better academic performance (Bandura, 1997; Paris & Newman, 1990; Schunk & Zimmerman, 1994; Vanderstoep et al., 1996; Weinstein & Mayer, 1986; Zimmerman, 2002; Zimmerman & Martinez-Pons, 1986). Furthermore, high-achieving students are more likely than low achievers to use a variety of cognitive strategies in their learning (Cleary & Zimmerman, 2000; Kitsantas & Zimmerman, 2002; Zimmerman & Martinez-Pons, 1986, 1988).

The various cognitive strategies involved in self-regulation accentuate the role of critical thinking as a subprocess that may enable learners to transform their mental abilities into performance outcome. In a similar vein, the proactive process of self-regulation may enable learners to acquire the academic skill of critical thinking, in this case, as manifested by the ability to interpret, analyse, and evaluate (Ignatavicius, 2001). Drawing from works cited previously, I outline three contentions as to why critical thinking and self-regulatory strategies are interrelated. First, as previous studies (Ignatavicius, 2001; Leung & Kember, 2003; Phan, 2006) have shown, critical thinking is a cognitive skill that enables learners to use deep processing strategies in their learning to dissect and evaluate classroom materials. This cognitive reflection (Kish et al., 1997), as defined by its characteristics, suggests that it could form part of the cognitive strategies used by self-regulated learners (Pintrich, 1999; Pintrich & Zusho, 2002; Zimmerman, 2002, 2008; Zimmerman & Schunk, 2001). In particular, taking into account the Zimmerman (1994, 2002, 2009) theoretical framework suggests that critical thinking may make its contribution in the self-reflection phase processes. In this analysis, the engagement of critical thinking during a given task may assist learners to handle ambiguity, take responsibility for their actions, and to develop confidence and self-efficacy beliefs when faced with rapid decision making (Kuiper, 2002).

The act of critiquing and questioning, and attempting to form one’s own alternative or solution may then, in turn, help foster the development of self-judgment and reflection. The development and complexity of critical thinking, in our view, require maturity, practice, nurturing, and effort over time (Ignatavicius, 2001). This long-term and detailed process, once developed, may provide learners with more informational source and wisdom to guide them in their judgment, monitoring, and reaction to imparted knowledge. By the same token, critical thinking also takes part in the cyclic self-regulatory phase that involves the subprocesses of self-efficacy beliefs, outcome expectations, intrinsic interest, and learning goal orientation (Pintrich, 1999, 2000; Pintrich & De Groot, 1990; Zimmerman, 2002, 2008).

In this cyclic process of self-regulation, the skill of critical thinking also situates in the metacognitive process of self-regulated learning. Metacognition, the ability to think about one’s own thinking process before, during, and after performing a task (Beitz, 1996; McKeachie, Pintrich, & Lin, 1985), may also be fostered by the engagement in critical thinking (Ignatavicius, 2001; Kuiper, 2002). A number of research studies have been conducted so far in the area of nursing, suggesting the important interplay between metacognitive processes and individual’s critical thinking and reflection in practice (Beitz, 1996; Brigham, 1993; Ignatavicius, 2001; Kuiper, 2002). For example, the nurturing of metacognitive skill via means of critical thinking enables nurses to be more autonomous in their practice. In this analysis, critical reflection and interpretation of information in an unbiased manner help learners to be more conscious and knowledgeable of their own cognitions (Diekelmann, 1993; Wilson, 1994). Furthermore, critical thinking skills also facilitate the transfer of metacognitive strategies across various situations (Kuiper, 2002). The ability to analyse and critique information at a high-order level provides learners with sophisticated and complex competency to engage in deep learning strategies, expend more effort into their learning, and to be more reflective in their planning and organisation. More research is needed to examine how the process of critical thinking propels individuals toward developing metacognition over time.

Second, based on existing evidence, the disciplinary practice of critical thinking is shaped by deep processing strategies (Phan, 2006), achievement goals (Phan, 2008a, 2009), and personal epistemology (Phan, 2008b). In terms of self-regulation, the key issue is concerned with the strategies that individuals may use to form their skill in critical thinking. The complexity of critical thinking suggests it is a long-term development process that requires practice, nurturing, effort, and reinforcement over time (Ignatavicius, 2001). One strategy that may be used to promote the growth of critical thinking is by means of self-regulation. In the area of nursing, for example, research evidence has shown that
Critical thinking skills are embedded within self-regulation strategy use (Kuiper, 2002). Kuiper (2002) found in her study that prompting self-regulation could serve as a pedagogical method to promote critical thinking in diverse clinical areas. According to the author, one self-regulation strategy that may be used includes clinical evaluations; in this approach, newly graduate nurses are asked to reflect and self-evaluate their performance using self-regulated learning prompts. Based on this evidence, it is pertinent that we encourage the use of self-regulation strategies as these strategies may provide the necessary internal support or scaffolding to help learners develop their expertise in critical thinking skills. More research is therefore needed to explore how self-regulation strategies may assist in the acquiring and development of critical thinking in education.

Drawing from existing research studies in critical thinking (Beitz, 1996; Ignatavičius, 2001; Kuiper, 2002; Phan, 2007, 2008a, 2009) and theoretical frameworks and research concerning self-regulation (Boekaerts et al., 2000; Corno, 1989, 1993, 2001; Graham et al., 1998; Ley & Young, 2001; Miller & Brickman, 2004; Pintrich, 2000; Schunk & Zimmerman, 1994, 1998; Zimmerman, 2002; Zimmerman & Schunk, 1998), researchers may wish to explore further the acquisition of critical thinking by means of self-regulation and what can be done to expedite this process. For example, the self-monitoring strategy of metacognitive self-regulation (e.g., assessing comprehension while reading) (Pintrich, 2000; Zimmerman, 1998) may provide a basis for learners to develop the skills of reflection. Likewise, another motivational belief that may be adaptive to critical thinking is self-efficacy. Researchers have shown that adaptive motivational beliefs such as students’ judgments of their capability to learn relate positively to cognitive and metacognitive strategies (Hammann, 2005; Pintrich & De Groot, 1990; Schunk, 1991; Zimmerman & Kitsantas, 1999). Research situating academic self-efficacy within the context of reflective thinking has also reported positive effects between students’ judgments of their academic capability and the understanding and reflection phases (Phan, 2007). In essence, contextualizing critical thinking within the framework of self-regulation (Pintrich, 2000; Zimmerman, 1998) suggests that self-efficacy, as a subprocess of self-regulation (Pintrich, 1999, 2000; Pintrich & De Groot, 1990; Pintrich & Zusho, 2002; Zimmerman, 2002, 2008), may facilitate the developmental process of critical thinking skills over time.

The conceptualisation of interplay between critical thinking and self-regulation in this article is based on previous theoretical contentions and empirical evidence. In this analysis, based on my examination, I contend that the two theoretical orientations operate in a cyclic pattern. This conceptualisation accentuates the importance of critical thinking, a framework that has been featured strongly in the literature but yet underresearched in the area of educational psychology (Baron, 2000; Kember et al., 2000; Leung & Kember, 2003; Phan, 2007, 2009; Sternberg, 2003; Thayer-Bacon, 2000; Watson & Glaser, 1980; West et al., 2008; Yanchar et al., 2008). Furthermore, the directions and implications recommended in self-regulation research (e.g., Boekaerts, 1999; Kramarski & Michalsky, 2009; Montalvo & Torres, 2004; Pintrich, 1999; Pintrich & Zusho, 2002; Zimmerman, 2008) may benefit from the inclusion of critical thinking. For example, the ongoing reconceptualisation of thematically-related models of self-regulation with the inclusion of critical thinking require further empirical validation and theorisation. There is still a need for more integrative models that can help us understand how critical thinking practice fits in with the learning contexts.

In their discussion of self-regulation, Montalvo and Torres (2004) emphasised a number of current and future directions concerning this topic in educational psychology. I contribute to this discussion on self-regulation with the specific inclusion of critical thinking as another theoretical orientation. The theoretical framework of critical thinking is significant as it helps educators to shape and influence students’ motivation for learning. Furthermore, critical thinking may help influence students’ self-regulatory processes, but at the same time its growth may be fostered by various self-regulatory strategies. The classroom environment is a salient issue and its structure may in fact promote growth in the developmental process of both critical thinking and self-regulation (Perry, 1998; Stoeger & Zigler, 2007, cited in Zimmermann, 2008; Zimmerman, 2008). It is important that future research studies explore the microanalytical structure and mechanism that define the cyclic interaction between critical thinking and self-regulation. Various methodological approaches and strategies, such as the use of classrooms observations, portfolios, and interviews may illustrate and capture the intimate intricate relationship that connects the two frameworks.

Conclusions

In this article/paper I have discussed two major theories in educational psychology: self-regulation and critical thinking. Research interest in the area of self-regulation has spawned a number of theoretical models to explain how such a theory could explain students’ motivation for learning (Corno, 2001; Montalvo & Torres, 2004; Pintrich, 1999, 2000; Wolters & Pintrich, 1998; Zimmerman, 1998, 2002). In contrast to this line of inquiry, moderate efforts have been made in the area of critical thinking and how this theoretical orientation explains students’ academic success in educational psychology. Despite its diverse definitions and interpretations, research situating critical thinking in the context of motivation is still in its infancy and requires further development and validation. There is an emerging body of research currently that explores the importance of critical thinking in students’ learning (Kember et al., 2000; Leung & Kember, 2003; Mezirow, 1998; Phan, 2007, 2008a). From a practical perspective, critical thinking assists individuals to think critically about their own learning and professional development.

The discussion in this article has provided a theoretically grounded conceptualisation of critical thinking and self-regulation in the context of teaching and learning. Based on previous research evidence and theoretical contentions, I integrated these two lines of theorising and research by suggesting that: (i) critical thinking acts as another cognitive strategy of self-regulation that learners use in their learning, and (ii) critical thinking may be a product of various antecedents such as different self-regulatory strategies.

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